REMARKS

The Office Action dated October 24, 2005 has been received and carefully noted. The following remarks are submitted as a full and complete response thereto. Claims 1-40 are currently pending in the application.

The Office Action indicated that claims 3-5, 11-15, 18-20, 25, 26, 32 and 36-40 were allowed, and Applicants acknowledge with appreciation the indication of the allowed claims. Therefore, claims 1, 2, 6-10, 16, 17, 21-24, 27-31 and 33-35 are respectfully submitted for consideration.

In the Office Action, claims 1, 2, 6-10, 16, 17, 21-24, 27-29 were rejected under 35 U.S.C. §103(a) as being unpatentable over Giroux (U.S. Pub. No. 2002/0089933) in view of Blanc (U.S. Patent No. 6,606,300). The Office Action took the position that Giroux discloses all of the elements of the claims, with the exception of a plurality of input logic units with each of the input logic units being associated with one of the receive ports and with each of the input logic units being operative to determine whether the associated receive port is saturated. The Office Action then relies upon Blanc as allegedly curing this deficiency in Giroux. The rejection is respectfully traversed for at least the reasons which follow.

Claim 1, upon which claims 2 and 6-10 are dependent, recites a shared memory packet switching device having a plurality of receive ports for receiving data packets, and a plurality of transmit ports for transmitting data packets. The switching device includes

a shared memory providing a shared memory space for temporary storage of data packets received via the receive ports, a plurality of input logic units with each of the input logic units being associated with one of the receive ports, and with each of the input logic units being operative to determine whether the associated receive port is saturated by determining whether a number of packets received via the associated receive port and currently stored in the shared memory exceeds a predetermined drop threshold value, a packet routing control unit communicatively coupled with the input logic units, and being operative to determine a destination one of the transmit ports for each of the received data packets and at least one output logic unit associated with at least one of the transmit ports, the output logic unit being communicatively coupled with the packet routing control unit, and being operative to determine whether the associated transmit port is congested by determining whether a number of packets currently stored in the shared memory that are to be transmitted via the associated transit port exceeds a predetermined congestion threshold value, and also being operative to generate an associated output full signal indicative of whether the associated transmit port is congested. The input logic units is responsive at least in part to each of the output full signals, and is further operative to cause a selected packet received via the associated receive port to be dropped if the associated receive port is currently saturated and the output full signals indicate that a destination transmit port associated with the selected packet is currently congested.

Claim 16, upon which claims 17 and 21-24 are dependent, recites a shared memory packet switching device having a plurality of receive ports for receiving data

packets, and a plurality of transmit ports for transmitting data packets. The packet switching device includes a shared memory providing a shared memory space for temporary storage of data packets received via the receive ports, a plurality of input logic units with each of the plurality of input logic units being associated with one of the receive ports, and with each of the input logic units being operative to determine whether the associated receive port is saturated by determining whether a number of packets received via the associated receive port and currently stored in the shared memory exceeds a predetermined drop threshold value, a packet routing control unit communicatively coupled with the at least one input logic unit, and being operative to determine a destination one of the transmit ports for each of the received data packets, the packet routing unit being further operative to generate a plurality of transmit signals each being associated with one of the transmit ports, and to assert a particular one of the transmit signals when a received packet is to be transmitted via the associated transmit port and at least one output logic unit associated with at least one of the transmit ports, the output logic unit being communicatively coupled with the packet routing control unit, and being operative to determine whether the associated transmit port is congested by determining whether a number of packets currently stored in the shared memory that are to be transmitted via the associated transit port exceeds a predetermined congestion threshold value, and also being operative to generate an associated output full signal indicative of whether the associated transmit port is congested. The packet routing control unit is also responsive to the output full signals, and is operative to generate a

plurality of filter signals for indicating that a received packet is destined for a congested one of the transmit ports. The input logic units is further responsive to each of the filter signals, and is further operative to cause a selected packet received via the associated receive port to be dropped if the associated receive port is currently saturated and the filter signals indicate that a destination transmit port associated with the selected packet is currently congested.

Claim 27, upon which claims 28-31 and 33-35 are dependent, recites a process of controlling the flow of data through a shared memory packet switching device having a plurality of receive ports for receiving data packets, a plurality of transmit ports for transmitting data packets, and a shared memory providing a shared memory space for temporary storage of data packets received via the receive ports. The method includes the steps of receiving a packet via an associated one of the receive ports, determining whether the associated receive port is currently saturated by determining whether a number of packets received via the associated receive port and currently stored in the shared memory exceeds a predetermined drop threshold value, determining a destination one of the transmit ports associated with the received data packet, determining whether the destination transmit port is currently congested by determining whether a number of packets currently stored in the shared memory that are to be transmitted via the destination transmit port exceeds a predetermined congestion threshold value and dropping the received packet if the associated receive port is currently saturated and the destination transmit port is currently congested.

Therefore, certain embodiments of the present invention enable an uncongested transmit port of the device to not starve as a result of flow control functions initiated at a saturated receive port as a result of heavy traffic through the device between the saturated receive port and a plurality of transmit ports including the uncongested transmit port and other transmit ports, some of which may be congested.

It is respectfully submitted that Giroux and Blanc, taken either individually or in combination, fail to disclose or suggest all of the elements of the presently pending claims. Therefore, it is further submitted that the cited references fail to provide at least the above-discussed advantages and features of the claimed invention.

Giroux discloses a congestion management system and method in a multi-port shared memory switch in a communications network. Giroux describes a switch receiving data from various sources and temporarily storing the data in a shared memory buffer. The switch also includes a local congestion monitoring means for setting and monitoring queue length thresholds for each output queue. When the queue depth for any queue exceeds a queue length threshold, a congestion control mechanism is implemented to limit incoming data traffic destined for that queue. The Office Action acknowledges that Giroux fails to disclose or suggest determining whether the associated receive port is currently saturated.

Blanc discloses a flow control process for a switching system which includes at least one switch core connected through serial communication links to remote and distributed Protocol Adapters or Protocol Engines through Switch Core Access Layer

(SCAL) elements. For each input port i, the SCAL element includes a receive Protocol Interface (PINT) for the handling of the particular protocol corresponding to the adapter being assigned the input port i and first serializing means for providing the attachment to the switch core by means of first serial communication links. When the cells are received in the switch core, they are deserialized by means of first deserializing means. At each output port, the cells are serialized by means of second serializing means and then transmitted via a second serial communication link to the appropriate SCAL. When the SCAL receives the cells, they are deserialized by second deserializing means and then transmitted to the Protocol Interface (PINT) circuit for permitting the attachment of the Protocol Adapter.

Applicants respectfully submit that Giroux and Blanc, whether considered alone or in combination, fail to disclose or suggest all of the elements of the present claims. For example, the cited references fail to disclose or suggest that "said input logic units being responsive at least in part to each of said output full signals, and being further operative to cause a selected packet received via said associated receive port to be dropped if said associated receive port is currently saturated and said output full signals indicate that a destination transmit port associated with said selected packet is currently congested," as recited in claim 1. Thus, in accordance with examples of the flow control methodology of the present invention, a packet is only dropped if: (1) the associated receive port is in a "full" or "saturated" state as indicated by the SELECT_DROP signal being asserted when $C_{IN}[N] \geq D_{TH}$; and (2) the transmit port 114 (see FIG. 2) to which the packet is

destined is in a congested state as indicated by the associated one of the FILTER[N] signals being asserted as further explained below (Specification, page 10, lines 10-16).

The Office Action appears to take the position that Giroux discloses the above-discussed element of the claims. However, Giroux merely discloses that when an output queue reaches its congestion threshold, congestion control is applied to the connections destined to this queue only. Giroux further discloses that when the shared buffer reaches its congestion threshold, the congestion control mechanism is triggered on the output queues which have exceeded their fair share of the memory pool (Giroux, paragraph 0026). Giroux does not disclose or suggest that a selected packet received via said associated receive port is dropped if said associated receive port is currently saturated **and** said output full signals indicate that a destination transmit port associated with said selected packet is currently congested, as recited in claim 1. In fact, Giroux specifically seeks to avoid the dropping of packets, and, therefore cannot possibly be considered to disclose the above-discussed limitation (see Giroux, paragraph 0003). Blanc also fails to disclose or suggest this element of the claims.

Similarly, Applicants respectfully submit that the combination of Giroux and Blanc fails to disclose or suggest "said input logic units being further responsive to each of said filter signals, and being further operative to cause a selected packet received via said associated receive port to be dropped if said associated receive port is currently saturated and said filter signals indicate that a destination transmit port associated with said selected packet is currently congested," as recited in claim 16, and "dropping said

received packet if said associated receive port is currently saturated and said destination transmit port is currently congested," as recited in claim 27.

Furthermore, Applicants respectfully submit that the combination of Giroux and Blanc fails to disclose or suggest "a plurality of input logic units with each of the input logic units being associated with one of the receive ports, and with each of the input logic units being operative to determine whether said associated receive port is saturated by determining whether a number of packets received via said associated receive ports and currently stored in said shared memory exceeds a predetermined drop threshold value," as recited in claims 1 and 16. Claim 27 recites the above limitation of claims 1 and 16, but is drawn to a process of controlling the flow of data through a shared memory packet switching device. Applicants submit that the cited references do not disclose or suggest at least this element of the claims.

According to certain embodiments of the present invention, a switching device 110 further includes a plurality of input logic units 116 designated INPUT_0, INPUT_1, INPUT_2, ... INPUT_3 each being communicatively coupled with one of the receive ports 112 as further explained below. Each of the input logic units is responsive to data packets received at the associated receive port 112, and is operative to determine current data flow conditions at the associated receive port, and is also operative to initiate backpressure assertion functions and packet dropping functions in accordance with a starvation free flow control methodology of the present invention. A received packet is only dropped by an associated input logic unit if it is determined that the associated

receive port is in a full or saturated state, and the destination transmit port 114 associated with the received packet is currently in a congested state (see Specification, page 6, lines 10-20).

The Office Action cites Blanc as allegedly disclosing the above-stated limitation of the claims (see Office Action, page 3). Applicants respectfully disagree. Blanc does not disclose or suggest input logic units with each of the input logic units being associated with one of the receive ports, as recited in the claims. The Office Action appears to take the position that elements 511i and 9001i correspond to the input logic units of the present invention. However, elements 511i and 9001i are circuits that are incorporated downstream of deserializer 1180. Blanc does not disclose or suggest that circuits 511i and 9001i are associated with one of the receive ports, as recited in the present claims. Moreover, the Office Action appears to take the position that elements 1600-1900 of Blanc are receive ports (Office Action, page 3). Blanc, however, discloses that elements 1600-1900 are protocol engine adapters that each provide a s/4 communication link (Blanc, Column 17, lines 23-25). Thus, Blanc does not disclose or suggest input logic units with each of the input logic units being associated with one of the receive ports. Giroux also fails to disclose or suggest this element of the claims.

Additionally, Applicants submit that Blanc does not disclose or suggest that "the input logic units being operative to determine whether said associated receive port is saturated by determining whether a number of packets received via said associated receive ports and currently stored in said shared memory exceeds a predetermined drop

threshold value," as recited in the present claims. Blanc merely discloses that when a cell is entered in cell buffer 9100, an IN pointer is incremented by one and, conversely, when a cell is extracted from the cell buffer 9100, it is an OUT pointer that is incremented (Blanc, Column 45, lines 8-11). The control circuit of Blanc uses the value of the difference between the two IN and OUT pointers in order to generate Flow Control Receive signals on lead 9003 that will be transmitted to the Protocol Interface element 511 (Blanc, Column 45, lines 39-42). Blanc does not disclose or suggest that input logic units are utilized to determine whether its associated receive port is saturated by determining whether a number of packets received via the associated receive ports and currently stored in the shared memory exceeds a predetermined drop threshold value. Giroux also does not disclose or suggest this element of the claims.

Therefore, for at least the reasons discussed above, the combination of Blanc and Giroux does not disclose or suggest all of the elements of claims 1, 16, and 27. As such, Applicants respectfully request that the rejection of claims 1, 16, and 27 be withdrawn.

Claims 2, 6-10, 17, 21-24 and 28-29 are dependent upon claims 1, 16, and 27, respectively. Applicants submit that these claims are not disclosed or suggested by the teachings of the cited references at least for the reasons given above, and because the dependent claims recite additional patentable subject matter. Additionally, claims 2, 6-10, 17, 21-24 and 28-29 should be allowed for at least their dependence upon claims 1, 16, and 27, and for the specific limitations recited therein. Thus, applicants respectfully

request that the obviousness rejection of claims 1, 2, 6-10, 16, 17, 21-24 and 27-29 be withdrawn.

Claims 30, 31 and 33-35 were rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Giroux in view of Blanc, and further in view of Basso (U.S. Patent No. 5,787,071). The Office Action took the position that Giroux and Blanc taught all of the elements of these claims, with the exception of asserting a backpressure signal when a backpressure threshold has been exceeded and the lines are bi-directional. Basso was cited as teaching these elements of the claims. The rejection is respectfully traversed for the following reasons.

Claims 30, 31 and 33-35 depend directly or indirectly from claim 27. Claim 27 is summarized above. Applicants submit that claims 30, 31 and 33-35 recite the patentable features of claim 27 discussed above.

Giroux and Blanc are discussed above. Basso discloses a hop-by-hop flow control in an ATM network. Basso describes traffic between nodes being set up by a reserved bandwidth service and/or non-reserved bandwidth service. The non-reserved bandwidth service is controlled by a hop by hop backpressure mechanism. When the traffic entering a node exceeds a high threshold, the backpressure mechanism generates stop backpressure primitives in order to throttle the entering traffic. In case of congestion, the mechanism is either able to selectively interrupt the connection contributing to the congestion without affecting the rest of the link traffic, or to globally stop all link traffic.

Applicants submit that Basso does not disclose or suggest those features of the claims missing from Giroux and Blanc. Specifically, the cited references do not disclose or suggest "determining whether said associated receive port is currently saturated by determining whether a number of packets received via said associated receive port and currently stored in the shared memory exceeds a predetermined drop threshold value," and "dropping said received packet if said associated receive port is currently saturated and said destination transmit port is currently congested," as recited in claim 27. Basso fails to cure the deficiencies in Giroux and Blanc, as discussed above. As such, the combination of Giroux, Blanc, and Basso does not disclose or suggest all of the elements of claims 30, 31 and 33-35. Thus, the cited references, either alone or in combination, do not disclose or suggest all the features of the presently pending claims.

Applicants respectfully submit that the cited prior art fails to disclose or suggest critical and important elements of the claimed invention. These distinctions are more than sufficient to render the claimed invention unanticipated and unobvious. It is therefore respectfully requested that all of claims 1-40 be allowed, and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicants' undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the applicants respectfully petition for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

Majid S. AlBassam
Registration No. 54,749

Customer No. 32294
SQUIRE, SANDERS & DEMPSEY LLP
14TH Floor
8000 Towers Crescent Drive
Tysons Corner, Virginia 22182-2700
Telephone: 703-720-7800
Fax: 703-720-7802

MSA:jf